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THERAPEUTICS
MATERIA MEDICA AND PHARMACY

THE SPECIAL THERAPEUTICS OF DISEASES AND SYMPTOMS, THE PHYSIOLOGICAL AND THERAPEUTICAL ACTIONS OF DRUGS, THE MODERN MATERIA MEDICA, OFFICIAL AND PRACTICAL PHARMACY, PRESCRIPTION WRITING, AND ANTIDOTAL AND ANTAGONISTIC TREATMENT OF POISONING

BY

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Unguentum Iodoformi Compositum.

℞. Iodoformi,..... ʒj.
Ol. Anisi,..... ♏xx.
Ol. Rosæ,
Ol. Ylang-ylang,.....āā ♏v.
Ung. Aquæ Rosæ,..... ℥j.
M. Fiat unguentum.
Sig.—Ointment.

Unguentum Anti-pruriticum.

℞. Camphoræ,
Chlorali Hydrati,.....āā ʒj.
Tere una ad liquorem, dein adde cum tritu—
Unguenti Aquæ Rosæ,..... ℥j.
M. Fiat unguentum.
Sig.—Ointment for itching.

Vina, *Wines* (Unofficial),—when medicated are practically the same as tinctures.

ELECTROTHERAPEUTICS*

Electricity as a therapeutic agent is employed more frequently now than ever before. The evolution from empiricism to accurate knowledge of some of the physiological effects of electricity has been gradual but sure, until at the present time it may be said that there is a sound scientific basis for the employment of electrotherapeutic measures.

In addition to its known value electricity has great future possibilities, and perhaps may solve some of the elusive and difficult physical problems that have hitherto resisted scientific endeavor. It is true that many conditions can be treated with greater benefit by drug or other measures than by electricity, but experience also teaches that in many pathological conditions, the benefits to be derived from the application of electricity are greater than those obtained by any other means.

Physiological Action and Therapeutics.

Electricity, though always the same force, is manifested in many ways and when modified and applied with knowledge, intelligence and skill, may be made to produce different physiological effects. It is upon this variability that the whole superstructure of electrotherapeutics rests. The known effects produced by electricity may be classified as follows: (1) Mechanical, (2) electrolytic or chemical, (3) counter-irritant, (4) thermic, (5) actinic, (6) psychic. These effects may be postulated, and it requires but simple logical deduction to reveal their application to rational therapeutics.

Mechanical contractions of nerves, muscles, ligaments and viscera may be produced by the interrupted galvanic, the plain or interrupted faradic, the sinusoidal, the static wave, static sparks, static induced current and the high frequency resonator discharge. These contractions may be general or local, slow or rapid, superficial or deep; irregular, or so rhythmical that they may be made exactly to synchronize with the heart beat. The employment of electrical contractions alternating with relaxations, accomplishes exercise without fatigue, with the incidental stimulating, developmental, eliminative

*By Dr. William L. Clark, Lecturer on Electrotherapeutics, Jefferson Med. Coll., Philadelphia. For an adequate presentation of the principles of electricity, the types of apparatus and methods of technic employed, which is not possible in this book, the reader is referred to special monographs.

and metabolic effects. All these currents have some particular indications, although there are conditions in which they may be used interchangeably or in combination.

The Electrolytic or Chemical action of the galvanic current is utilized to advantage in medicine, and offers a fruitful field for future research work. The destruction of small growths and treatment of hypertrichosis by electrolysis is well known. By a method known as *ionic medication*, various drugs may be introduced into the tissues. Copper, zinc, silver, mercury, magnesium and other metals may be separated from their salts and driven into the tissues from the anode, as may cocaine, morphine or aconite. Iodine, the salicylates and other useful drugs are driven in from the kathode. The advantage of ionic medication over introduction of the drug through the alimentary tract is that the direct application of drugs insures a maximum effect, while when introduced by the stomach, chemical changes and distribution of action may materially lessen the local potency of the remedial agent. The opposite poles have opposite chemical reactions, the positive being acid in reaction, while the negative is alkaline; the positive contracts; the negative dilates; the positive is sedative; the negative is stimulating.

Heating of tissue is produced by the various forms of high frequency currents and from carbon, tungsten and nitrogen therapeutic lamps. The effect produced by a high frequency current may range from a slight irritation of the skin and the production of a simple hyperemia, to actual coagulation, desiccation or incineration. The action may be localized in one area or generalized over the surface of the whole body. The current may penetrate the body at given points; a joint may be heated, as may the liver, lung, kidney, or indeed any organ. This heat may also be distributed equally through every portion of the organism with a consequent elevation of the body temperature. The heat from electric therapeutic lamps, as far as is known, is comparatively superficial, although the lamps furnish a convenient method of applying surface heat, and are of undoubted value.

All degrees of *counterirritation* may be produced by the application to the skin of the galvanic and high frequency currents, the static brush discharge, heat from electric therapeutic lamps, and the ultraviolet rays. The counterirritation from the ultraviolet rays is more lasting in effect than that obtained by the other methods.

Actinic effects are produced by some of the spectral and extra spectral rays generated by electrical currents. Blue rays are known to be sedative and red rays stimulating. The action of the other spectral rays are not so well determined. Very little is known of the action of infra-red except that of heat. The ultraviolet rays are strongly actinic and are bactericidal in action to a marked degree, very stimulating and irritating, even to the point of producing the destruction of superficial tissue. Under modifications of application, consisting of filtration of irritating wave lengths by interposing blue ultraviolet glass, and compression of tissue for the purpose of producing

ischemia by quartz lenses while the rays are passing through, these rays may be made less irritating. The rays cannot penetrate any substance colored red, hence the necessity of producing a temporary ischemia to insure penetration by the rays. Under ischemia, the penetration is from one to four millimeters. The ultraviolet rays may be used with success in some skin lesions and in such systemic conditions as are benefited by sunlight. The *x*-ray properly comes under electrotherapeutics, but because of the extent of the subject and the numerous excellent text-books dealing with it in a special way, it will not be discussed here.

The beneficial *psychic* influence of electricity upon some impressionable patients is undoubted, and is welcomed in the treatment of such conditions as hysteria and hypochondriasis, but this is the least of the beneficial effects of electricity, and not the greatest, as some have taught. There is an influence aside from the psychic one. It may be safely asserted that the individual who comes in unexpected contact with a live wire does not die from the psychic effect; conversely the therapeutic application of a selected current benefits the recipient.

Let us now consider some of the fallacious teaching.

1. The word *modality* seems to have been recently coined and is used frequently in literature dealing with electrotherapeutics to express the particular method employed in a given case. There is no necessity for coining this word, as the terms current, method or mode amply express the intended meaning.

2. The belief that the galvanic current on account of its low voltage follows the surface of the body and does not penetrate into the deep tissue, is an erroneous one. The dry skin is a poor conductor, but when it is moistened electricity passes through it with ease. The deeper tissues are largely of saline fluid composition, therefore, they are a good conducting medium, and the galvanic current passes through them freely. Living bone, with its constant moisture, is a much better conductor than the skin. The brain is acted upon perhaps more freely than any other tissue, because of the large percentage of fluid of which it is composed, and the current easily reaches the brain because it is a better conductor than either the scalp tissue or the cranium. The action of the galvanic current upon the brain is shown by the dizziness or even syncope which results when the current is passed transversely and not longitudinally; this also results from a sudden break in the current or when the circuit is opened and closed too suddenly. When the galvanic or any other current is applied in a bath and the body is submerged during the passage, the action is largely upon the skin surface, because it requires less electro-motive force for the current to pass through the water than through the skin to the deeper tissues.

3. It has been asserted that high frequency currents produce their effects by various mystical influences, among which has been mentioned "fine

cellular massage." There is no evidence to show that there is any action other than that of heat, but it may be truthfully said that for the superficial or deep application of heat, with its known benefits, high frequency currents hold first place.

4. The application of high frequency glass vacuum tubes is often erroneously called ultraviolet ray treatment. Ultraviolet rays will not penetrate ordinary glass. If the tube is held a short distance from the body allowing the sparks to pass through an air space, a very small amount of ultraviolet rays that may reach the skin is generated, but not a quantity sufficient to produce any therapeutic effect. Practical ultraviolet rays can be produced only by iron carbon or quartz mercury-vapor lamps, and projected through clear water, air or rock crystal. The quartz mercury-vapor lamps are much more powerful than the iron carbon lamps and have largely superseded them.

5. Physical contractions by the static wave current and static sparks have been recommended for acute neuritis for the purpose of aborting or shortening the attack, by hastening the absorption of exudates, promoting tissue drainage, relieving pressure, reducing muscle spasm and alleviating pain. This is a plausible theory, but does not work out in practice in the case of acute neuritis. Because of its high voltage and relatively low amperage, the static wave current is less irritating than the interrupted galvanic and faradic currents, and may do less harm, but even so, why treat an acutely inflamed nerve by any manipulation, no matter how slight, that produces trauma?

Absolute rest and immobility are the first indications. In addition, heat from electrical sources, such as high frequency currents and therapeutic lamps, or mild positive galvanism to lessen nerve irritability, may be used to advantage. Mechanical or electrical contractions should never be induced during the acute stage of a true neuritis, whatever the anatomic location. During the sub-acute and chronic stages, the static wave current and static sparks, together with *diathermy* may be used, and will not only give relief, but also materially hasten the cure. Reported cases of acute neuritis aborted or cured by the static wave current and static sparks probably were not cases of true neuritis at all, but neuralgias or myalgias. For the relief of muscle spasm these currents are exceedingly valuable. In cases of inflammation due to infection, or in cases where pus is present, electrical contractions are always contraindicated and may produce harmful results. High frequency currents, ultraviolet rays and radiant light and heat may be used to advantage to promote phagocytosis before and after incision and drainage.

6. Another error is the claim of the reduction to normal size of large fibrous prostates. Honest but mistaken physicians have reported that these results have been obtained and have indeed gone so far as to assert that operative surgery can be dispensed with in these conditions. What really has been accomplished is the relief of the superimposed infiltration and chronic

inflammation, the abatement of which ameliorated or obviated the symptoms. The static wave current is extremely valuable for this purpose, and may obviate the need for surgical interference in cases that would otherwise require prostatectomy. In cases of hypertrophied fibrous prostates, in which the tissue drainage affected by the static wave current does not relieve the coincident congestion sufficiently to abate the symptoms, and in which there is an accompanying cystitis, bladder atony and dilatation, the Roentgen ray may affect the fibrous tissue as it does the tissue of uterine fibroids. If the application of the ray produces no improvement, prostatectomy is the only means of relief, unless it be permanent catheter life. An acutely inflamed prostate should not be treated by the static wave current for the same reason that an acute neuritis should not be so treated.

7. There is a widespread belief that the static positive and negative poles may be used interchangeably. This is an error inasmuch as sedative or irritating effects are dependent upon the polarity.

8. It is claimed that ozone generated by the high frequency current and passed through aromatic oils (for the purpose of absorbing the irritating nitrous acid, which is generated with the ozone) is beneficial in diseases of the respiratory tract, such as catarrh, bronchitis and tuberculosis. Pure ozone alone is irritating to mucous membranes, and much more so when mixed with nitrous acid, which is seldom if ever entirely absorbed by the oils. Ozone is very unstable, and even though it did possess virtue it could not reach the throat or lungs in a pure state, because of the chemical combinations it would form, especially with nitrogen, before reaching its destination. Its use should be condemned because it produces an irritating effect and aggravates the conditions rather than relieves them. There may be some beneficial effect from nebulized oils alone, but not from ozone passed through them. This so-called ozone therapy has been a fruitful field for charlatans and many have been its victims.

9. In the case of pathologically incurable diseases, such as locomotor ataxia, paralysis agitans, chronic Bright's disease, diabetes, etc., extravagant claims too ridiculous for refutation have been made for electricity. The employment of electricity is amply justified in these cases, for the improvement of metabolism, the promotion of comfort and the prolongation of life, but no cure can be expected.

10. The question of the value of high frequency currents for the reduction of blood pressure is of interest to the profession, and there is much difference of opinion regarding it. Indeed, some eminent therapeutists have declared them to be of no value whatever. *Autocondensation*, if administered properly, is a very valuable adjunct to dietetic, pharmacal, hydrotherapeutic and hygienic measures, in cases where the reduction is indicated, especially when autointoxication is the causative factor. In chronic nephritis, the rise in blood pressure may be a compensatory condition, and it may not be pru-

dent to lower it beyond a certain point. Autocondensation acts by the dilatation of the peripheral vessels, thus producing an equalization of the circulation and probably increased oxidation and elimination. Increased specific gravity of the urine is noted after autocondensation treatment; to some extent this may be due to greater concentration after an increase of perspiration. It is often possible to reduce the pressure from ten to twenty points, or even more, by one treatment. With continued treatment, there is more or less permanency in the reduction, although this doubtless is partially due to other measures coincidentally employed. Were it necessary to choose between ordinary rational measures and autocondensation, the former would be chosen as first in value, but when both are used together, there is no doubt that better results are accomplished than when either is used alone. This conclusion has been reached after years of careful observation. It may be added that static wave currents elevate the blood pressure in the case of hypotension, while high frequency currents lower it when hypertension exists. The following are a few conditions in addition to those already mentioned that may be successfully treated by electricity, together with the types of current employed:

Intestinal impactions and obstructions are favorably influenced by the dilating and softening action of negative galvanism, the bowel having first been distended by normal saline solution, which acts as the conductor of the current. In some cases of intestinal stasis and chronic constipation the patients recover under treatment by the interrupted galvanic and faradic sinusoidal, static induced and static wave currents.

Ziegler, of Philadelphia, has reported good results from negative galvanism in glaucoma and in some cases of optic atrophy; and from positive galvanism in plastic iritis, spongy iritis, iridocyclitis, choroiditis and intraocular hemorrhage. These results have been verified by other eminent ophthalmologists. Bell's palsy usually responds to treatment by negative galvanism.

Some cases of lumbago and sciatica are quickly relieved by the static wave current, static sparks and diathermy. Regeneration after anterior poliomyelitis, simple or multiple neuritis, hemiplegia or muscular atrophy from any cause is hastened by the use of interrupted galvanism, faradism, sinusoidal current and diathermy.

There is evidence that patients placed in an electromagnetic field may be relieved of conditions of nervous instability, Successful treatment of chorea has been reported. Conditions of nerve exhaustion or neurasthenia are benefited by the static breeze and static bath. Tic douloureux is frequently controlled by diathermy, salicylic ionization and radiant light and heat.

Obesity is benefited by the Bergonie method of general faradization.

Simple goitre improves under iodine ionization.

Anal and other fistulas often heal following copper or zinc ionization.

Chronic cystitis often may be satisfactorily treated by copper or zinc ionization, the bladder being distended with a weak aqueous solution of copper sulphate or zinc chloride, the water acting as a conductor of the current and the drug being dissociated in the bladder wall.

The electric incandescent lamp cabinet bath is valuable to dilate the peripheral vessels and to produce diaphoresis in conditions where increased elimination is indicated. The bath has an advantage over the Turkish baths in that the patient is not subjected to the deleterious influences of vitiated air.

Chronic articular rheumatism and rheumatoid arthritis improve under the application of diathermy, the static wave current, static sparks and salicylic ionization.

Effusions after sprains or other trauma are often rapidly absorbed by the use of the static wave current and static brush discharge.

Chronic leg ulcers are favorably influenced after treatment by zinc ionization and ultraviolet rays.

The sterilization of wounds or prevention of surgical infections is frequently accomplished by the ultraviolet rays, and by ionization. These methods are being used extensively and with success in the present European war.

Infantile uteri, whether congenital or due to superinvolution, often develop under negative galvanism, and the relief from sterility from this cause frequently follows. There is no other method so effective as this one. Remarkable results have been reported by Dr. Barton Cooke Hirst of Philadelphia.

Physiologic involution of a subinvoluted uterus usually follows treatment with positive galvanism.

Some cases of endometritis respond to copper and zinc ionization.

Hyperchlorhydria and atony of the stomach improve under negative galvanism applied by means of intragastric electrodes, water in the stomach acting as a conductor. These electrodes are first swallowed and then withdrawn after the treatment.

As an adjunct to other measures, the treatment of surgical and pulmonary tuberculosis by diathermy, which consists of heating joints, lungs, etc., to a temperature sufficient to produce hyperemia, is highly beneficial. In the case of lung cavities, care must be taken in regulating the thermic intensity to avoid the danger of pulmonary hemorrhage.

Resuscitation by means of strong rhythmical faradic shocks over the diaphragm, precordia and the phrenic nerve, may be possible after ordinarily lethal accidents due to chloroform, opium, electrocution, drowning or gas asphyxia.

Some urethral, esophageal and rectal strictures, also uterine stenosis, yield to treatment by negative galvanism. Careful technic must be practiced to insure success.

A notable achievement is the destruction of papillomas and some other bladder growths by means of the high frequency current applied through a cystoscope. This method of destruction is also applicable to growths of the larynx, esophagus, rectum, urethra, vagina and uterine cervix, when suitable endoscopes are used to expose the growths.

Hypertrophic infected tonsils may be reduced by the desiccation method.

Some malignant growths in accessible regions, even where bone is involved, may be treated with success by the high frequency desiccation, surgical diathermy, de Keating Hart's method of fulguration (which is used in combination with operative surgery), and zinc-mercury ionization. Care should be taken with these methods, except de Keating Hart's fulguration, when working near large blood-vessels, as secondary hemorrhage may result on separation of the slough.

Electrolysis is the only reliable method for the treatment of hypertrichosis.

Tattoo marks may be removed by the desiccation method. Nevus flammeus, lupus, acne, eczema, psoriasis and some types of alopecia often may be treated with success by the ultraviolet rays.

The electrocautery is well known and is used extensively throughout the medical world for sterilizing wounds and for general surgical purposes.

These few illustrations give some idea of the almost limitless field of usefulness open to electricity.

The following are some of the future possibilities in electrotherapeutics: The abstraction of metallic poisons from the body, such as mercury, arsenic, lead, etc., by ionization. This is theoretically feasible, in fact, good results have been reported. Safe local and general anesthesia with loss of consciousness and perfect relaxation seems possible through the application to certain brain and nerve centres of a rapidly interrupted galvanic current, known as the Leduc current. This has been demonstrated by animal experimentation and Leduc himself submitted to the experiment and pronounced it successful. There has been some controversy over the practicability of this method, however, and for this reason it may be said that it is yet in the experimental stage. It seems possible that analgesia from pain due to any cause and the rapid induction of natural sleep may sometime be accomplished by sedative action on the nerve centres or by peripheral nerve blocking, thus lessening the necessity for the use of opiates. It is not beyond the bounds of possibility that a method may be established whereby electrical means may be used to promote the formation of antibodies against some forms of infectious diseases. There is at least theoretical basis for the hope that future research may bring about a realization of all these desirable results, visionary though they now may seem.

The present attainments and future possibilities of electrotherapeutics are surely sufficient to make a serious study of the subject worth while.

RÉSUMÉ.

Success in electrotherapeutics depends on an adequate knowledge of physiology and pathology as related to the human body; on a mastery of the laws that govern electricity; on the possession of efficient apparatus, the achievement of good technic by practice and the good judgment to apply all these acquirements to the best advantage. Given two men with the same apparatus, one may get excellent results and the other poor results, for the same reason that in the hands of one, calomel may be a potent remedy, while in the hands of another it would fail.

Electrotherapeutics is not a system to be used to the exclusion of other therapeutic measures, but is a worthy additional unit to any physician's armamentarium. Competence in this, as well as in other methods of physical therapy, will do much to discourage irregular practitioners who are thriving on charlatanism.